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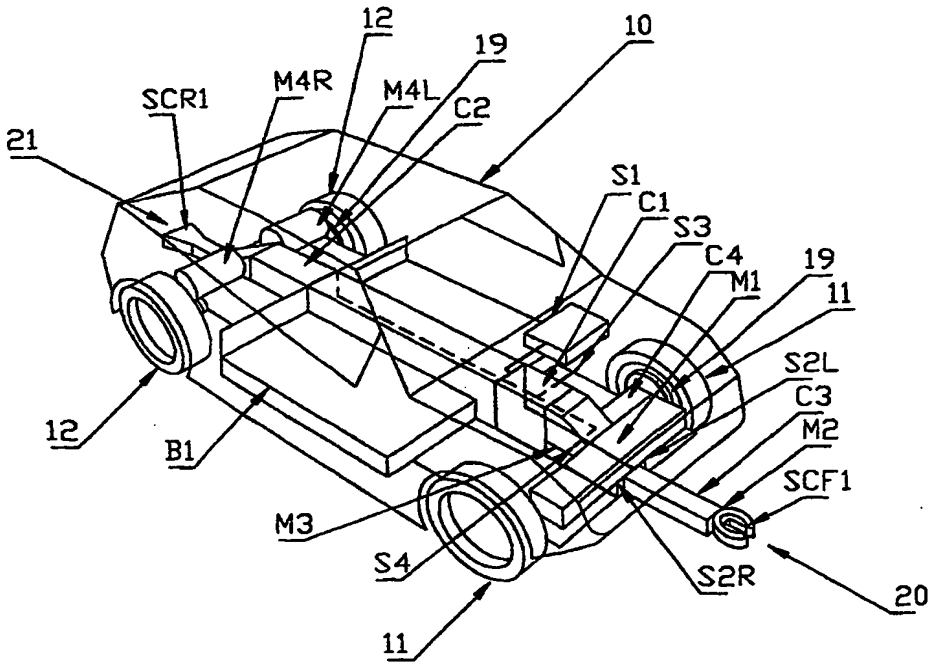

(57) Abstract

A vehicle (10) which is usually a motor car, minibus, delivery van or the like has coupling means (20, 21) at the front and rear so that the vehicles can be connected together as a train. Power and data can be fed from vehicle to vehicle or from a power vehicle at the front.

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TRANSPORTATION SYSTEMS

FIELD OF THE INVENTION

This invention relates to transportation systems and is applicable particularly, but not exclusively to wheeled transportation systems for use in transporting persons.

BACKGROUND

For many years, communal type of person transportation systems have existed, such as trains, buses, trams and trolley buses. Such systems have advantages such as low running costs per person, per mile, low adverse effects on the environment and low fuel consumption compared with transporting individual persons in separate internal combustion engine motor cars. Furthermore, the persons being transported do not have the stress of driving and can occupy the time more advantageously and pleasantly.

However, such communal transportation systems suffer disadvantages such as:

(a) each person has to travel on foot, or by other means, to the point at which they board the train, bus or the like. At the end of that journey the person usually has to make another journey on foot or otherwise to their destination,

(b) such journeys, before boarding or after leaving the train or the like may be in unpleasant weather,

(c) there is a risk of personal attack or at least unpleasantness either while on the train or the like or before or after travelling on it,

(d) the service provided by the train or the like may be infrequent, leading to wasted time.

As a consequence of those deficiencies in typical communal transportation systems, a preferred alternative transportation system has naturally evolved, especially for the majority of home-to-work commuting journeys.

This preferred system involves each person owning their own motor car, at present almost invariably powered by an internal combustion engine. Thereby, they can travel in the security, comfort and versatility of their own vehicle.

However, even this preferred system has several disadvantages including:

(a) since the centre length of such journeys is often on arterial roads or motorways at higher speeds, the car has to have a higher powered engine than is needed for the end parts of the journey. Especially with internal combustion engines, the end parts of the journey are made with the engine running inefficiently and wasting fuel,

(b) it is necessary to keep a distance from the car in front equal to at least 2 seconds of travelling, at any speed. This leads to full roads and to the need for constant vigilance when driving,

(c) with the desired use of electrically driven cars, only comparatively short journeys are possible within current technology, particularly if the higher powers required for the centre length of the journey are utilised.

OBJECT

It is an object of the present invention to provide transportation systems which give at least some of the advantages of the communal transportation systems and of the personal transportation systems and to avoid at least some of the disadvantages of both said systems.

Principally, the invention aims to promote:

a) a high vehicle throughput to minimise traffic choking and delays,

b) system flexibility permitting the user choices of private ownership, rental, single trip payment, choice of route, reasonable range, timing of trip,

c) overall energy efficiency in the construction and operation of the system,

d) reduced emissions of pollutants associated with motor vehicles,

e) low overall costs as regards the provision of infrastructure, as opposed to, for example, the installation of light rail transit.

STATEMENTS OF THE INVENTION

According to one aspect of the present invention there is provided a vehicle including a driving motor connected to drive the vehicle along, first and second coupling means, the first coupling means being adapted to connect to the second coupling means of a similar vehicle and the second coupling means being adapted to connect to the first coupling means of a similar vehicle, whereby two or more of said vehicles can be connected together by said coupling means to form a train.

Preferably the first and second coupling means are connectable and/or disconnectable automatically and/or remotely from the coupling means.

Conveniently the vehicle is a wheeled vehicle and may be provided with seating for one or more persons and advantageously for not more than twelve persons i.e. a private car or small bus.

Preferably the coupling means are capable of transmitting tensile and/or compressive forces, whereby vehicles in the train can tow or brake those behind.

Advantageously, the coupling means are capable of transmitting electronic data and power, such as electricity where the motor is an electric motor, from one said vehicle to the next.

Preferably, the vehicle is provided with steering equipment and the first and/or second coupling means includes transverse force detection means connected to operate or control said steering equipment, whereby to cause vehicles in the train to follow in the

same track as the vehicle in front and to suppress transverse oscillations of the train.

Advantageously, the coupling means are capable of passing therethrough signals to control the power output of said motors or the retarding force generated by brakes on the vehicle and/or information signals such as electrical pulses.

According to another aspect of the invention there is provided a power vehicle including a store or source of power and including said first and/or second coupling means whereby power and data from the power vehicle can be passed to and/or from vehicles in said train.

Conveniently the power vehicle includes a prime mover, an electricity generator driven thereby and/or an electricity storage device.

According to a further aspect of the present invention there is provided a train, which may be a road train, including a plurality of said above-mentioned vehicles.

Preferably the train includes at least one of said power vehicles connected in the train at the front and/or the rear thereof and/or at an intermediate position along the length thereof.

According to yet another aspect of the present invention there is provided a method of operating a plurality of said vehicles, including the steps of driving the individual vehicle or groups of said vehicles to an assembly point, forming the individual vehicle or groups thereof into a train or joining them to a train by use of said coupling means, driving the train from the assembly point to a dispersal point, disconnecting at least some of the coupling means to release at least some of the vehicles from the train and driving those released vehicles individually or in groups away from the dispersal point.

Various embodiments of the invention are described by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a perspective diagrammatic view of a motor vehicle capable of being used in a transportation system according to the invention,

Figure 2 is a side view at reduced scale of a train incorporating vehicles of the type shown in Figure 1,

Figures 3 and 4 show alternatives to Figure 2.

Figure 5 is a diagrammatic plan view of a front tow-bar used in Figure 1, and

Figure 6 is a diagrammatic plan view of a rear tow-bar used in Figure 1.

In Figure 1, a motor car 10 has front and rear wheels 11, 12 respectively. The front wheels 11 are steered by a steering actuator C1. The rear wheels 12 are each driven by electric motors M4R, M4L fed with electricity from an energy storage device B1 through a controller C2. The wheels 11, 12 are braked by brakes 19 with anti-lock control. The wheels 12 are initially braked by regenerative electric charging, with anti-lock control.

The front and rear of the car 10 have affixed thereto and protruding therefrom, front and rear couplers 20, 21. The couplers 20, 21 are designed and arranged so that when one of the cars 10 drives up to a similar car in front, the coupler 20, extends so as to engage coupler 21 to co-act and thence perform various functions.

A first requirement is for the couplers 20, 21 to keep the cars 10 at a predetermined distance apart, front-to-rear. Generally, this is achieved by an electro-mechanically releasable catch system of a kind which allows articulation between adjacent cars 10 in vertical and horizontal planes, as achieved by a ball and socket joint, for example.

Alternatively, the first requirement may be met by use of sensors in the couplers 20, 21 which detect the relative position, in a fore-and-aft direction of the adjacent cars 10. Output of the fore-and-aft sensors is used to control the motors M4R, M4L and/or brakes 19 of either or both of the cars 10.

A second requirement of the couplers 20, 21 is to transmit electrical power, for driving the motors M4R, M4L from one car 10 to the next. For this purpose, suitable electrical contacts are built into the couplers 20, 21, the contacts being able to conduct despite any normal articulation or fore-and-aft movements between the couplers 20, 21.

A third requirement is to transmit information signals, such as electrical pulse trains or the like from one car 10 to the next.

A fourth requirement may be to detect lateral force exerted from one coupler 20, 21 to the other. Trains of wheeled vehicles, especially those having rubber tyred road wheels are inherently unstable laterally and tend to "snake". By measuring the lateral force by means of sensors S2L and S2R in one or both of the couplers 20, 21, a stabilising force can be imposed on the steering mechanism, as by an actuator M1. Alternatively a lateral acceleration transducer on the car 10 may be used to control the actuator M1.

Figure 5 shows the front coupler 20 in more detail. An outer tubular casing 30 is fastened firmly to the centre front of the car 10. An inner tubular casing 31 is a sliding fit within the outer casing 30 and carries at the front end a U-shaped outer yoke 32 in which a U-shaped inner yoke 33 is rotatable by a worm gear 34 engaged with teeth on the outside of the inner yoke 33.

As shown in Figure 5, the yokes 32, 33 are aligned so that a vertical pin 35, shown in Figure 6, can enter from the front and pass to the centre of the yokes 32, 33. When the worm gear 34 is rotated by supply of electric current to an electric yoke drive motor or coupling lock M2.

A threaded bar or drive worm 37 extends along the centre of the casings 30, 31 and is rotatable but axially fixed in the rear of the outer casing 30. A bar drive motor M3 is affixed to the casing 31 and rotates the bar 37 when fed with electric current. A nut member 39 is threaded on the bar 37, adjacent the centre thereof. A pair of plain rods 40 are parallel to the threaded bar 37 and are a sliding fit therethrough. The rods 40 are axially located between front and rear blocks 41, 42 fastened in the inner casing 31.

A pair of compression towing springs 43 are positioned around the rods 40 between the nut member 39 and the front block 41.

Similarly, a pair of compression over-run springs 44 are positioned around the rods 40 between the nut member 39 and the rear block 42.

A guide pin 45 is mounted on a transverse pivot 46 in the front end of the inner casing

31. and is biased by a spring 47 to extend radially downwards through the bottom of the inner casing 31.

When the car 10 is not to be connected to a car in front, the bar drive motor M3 is rotated so that the nut member 39 is drawn rearwards. The springs 43, 44 urge the inner casing 31 to retract into the outer casing 30, the front of which causes the guide pin 45 to be raised up inside the inner casing 41.

In Figure 6 the rear coupling 21 includes an elongate member 48 mounted to the car 10 on a vertical pivot pin 49, and has limited articulation. The member 48 carries at the rear thereof a short member 50 on a transverse pivot pin 51 centralised by springs 52.

Convergent guide plates 53 are fastened on the rear of the short member 50 and carry the vertical locking pin 35. Thus, as two cars 10 move towards each other, the yoke 32 is guided by the plates 53 until the locking pin 35 is centered in the yokes 32, 33, whereupon the inner yoke 33 is rotated to retain the locking pin 35 and couple the cars 10 together.

When the car 10 in front is towing the car 10 behind, the pull on the yoke 32 pulls the inner casing 31 out of the outer casing 30, thereby compressing the towing springs 43. Similarly, when the car 10 behind is over-running or pushing the car 10 in front, the inner casing 31 is pushed into the outer casing 30 causing the over-run springs 44 to be compressed. The outward or inward movement of the inner casing 31 relative to the outer casing 30 is measured by transducers S3, S4 which feed to controller units C2.

Steering input by the driver, for example by rotation of a steering wheel, is sensed by a sensor unit S1 connected to the steering control unit C1. Lateral forces on the yokes 32, 33 are sensed by sensors S2R and S2L which also feed into the steering control unit C1. The various control units, sensors and motors are listed in Table 1 and their uses and functions are shown in Table 2.

Although the car 10 is most conveniently the kind driven by electric motors M4R, M4L, it could be driven by a hybrid power source such as a substantially constant-speed internal combustion engine driving an electricity generator to charge the energy-storage device B1 and/or power the motor M4R, M4L.

In the simplest mode of using the car 10 in a train, the car 10 is driven disconnected from any other cars to an assembly point at which it is coupled, by the couplers 20, 21 to one or more cars 10 similarly equipped to an existing train of such cars 10. Electrical signals passed through the couplers 20, 21 control the motors M4R, M4L through the controllers C2 to accelerate all the cars 10 in the train together. Similarly the electrical signals can be used to apply the brakes 19 simultaneously, or cause regenerative braking to be initiated. The train is preferably controlled by the driver of the front car 10, the drivers of the other cars 10 in the train taking no further part in the train operation.

The train proceeds thus to a dispersal point at which the cars 10 are disconnected from each other and then drive away separately. If required, the train can stop at intermediate points and any car in the train can disconnect itself and drive away separately. The remaining cars in the train can re-connect and proceed on their journey.

In a more sophisticated and beneficial mode of using the cars 10, the separate cars 10 are driven to the assembly point as described above. However, in this case, as shown in Figure 2, the train 24 of cars 10 is headed by a power vehicle 23. This is in the nature of a heavy goods vehicle which preferably includes an engine generating enough power to drive itself and to pull the cars 10 in the train 24, without using motors M4R, M4L of the cars 10.

Alternatively, the power vehicle 23 has a motor generator capable of generating enough electricity to be fed through the couplers 20, 21 to the motors M4R, M4L of the cars 10 and thereby to drive the cars 10 in the train 24 without drawing electricity from their energy storage device B1. The motor generator or energy storage device on the power vehicle 23 may have enough surplus electricity to charge the energy storage device on the cars 10, as the train 24 drives along. As before, the driver of the power vehicle 23 controls the operation of the motors, brakes and possibly steering of the cars 10 in the train.

A computer on the power vehicle 23, possibly used in conjunction with charge cards held by the drivers of the cars 10, enable a charge to be made for electricity supplied to charge the batteries B1 and/or for a charge for the distance travelled while the car 10 forms part of the trains.

Such charge cards may also be used to control initial access to the car and its controls.

Figure 3 shows a form of train 24 composed of the power vehicle 23, a 12-seater minibus 25 and several cars 10.

Figure 4 shows a similar train 24, but including only a comparatively few cars 10, so that a smaller power vehicle 23 is adequate.

The transportation system described above can be used in a versatile manner by the driver being able to lease or hire a different type or size of the car 10 to suit the driver's requirements on that occasion.

For example, if the driver is driving alone for short journeys between home and the assembly point and between the dispersal point and work place, with perhaps short errands during the day, an electric mini-car is sufficient.

If the driver has to take several young persons and their equipment to a local evening activity, an electric van would be appropriate to choose. For local carriers of goods, an electric pick-up truck could be utilised.

The power vehicle 23 and/or the motor generator could be driven by efficient engines, such as diesel, Stirling cycle, hydrogen fuel cell or advanced gas turbine engines as appropriate.

Clearly such a versatile transportation system would lead to less energy used overall and would reduce pollution.

Additionally, if properly managed, the existing roading capacity might be increased by an order of magnitude.

CLAIMS

1. A vehicle including a driving motor connected to drive the vehicle along, characterised by first and second coupling means, the first coupling means being adapted to connect to the second coupling means of a similar vehicle and the second coupling means being adapted to connect to the first coupling means of a similar vehicle, whereby two or more of said vehicles can be connected together by said coupling means to form a train.

2. A vehicle as claimed in claim 1 characterised in that the first and second coupling means are connectable and/or disconnectable automatically and/or remotely from the coupling means.

3. A vehicle as claimed in claim 1 or 2 characterised in that the vehicle is provided with seating for one or more persons and not more than twelve persons.

4. A vehicle as claimed in any preceding claim characterised in that the coupling means are capable of transmitting tensile and/or compressive forces, whereby vehicles in the train can tow or brake those behind.

5. A vehicle according to any preceding claim characterised in that the coupling means are capable of transmitting electronic data and power, such as electricity where the motor is an electric motor, from one said vehicle to the next.

6. A vehicle according to any preceding claim wherein the vehicle is provided with steering equipment characterised in that the first and/or second coupling means includes transverse force detection means connected to operate or control said steering equipment, whereby to cause vehicles in the train to follow in the same track as the vehicle in front and to suppress transverse oscillators of the train.

7. A vehicle according to any preceding claim characterised in that the coupling

means are capable of passing therethrough signals to control the power output of said motors or the retarding force generated by brakes on the vehicle and/or information signals such as electrical pulses.

8. A vehicle, according to any preceding claim, which is a power vehicle including a store or source of power characterised by including said first and/or second coupling means whereby power and data from the power vehicle can be passed to and/or from vehicles in said train.

9. A vehicle according to claim 8 characterised in that the power vehicle includes a prime mover, an electricity generator driven thereby and/or an electricity storage device.

10. A train, for example, a road train, characterised by including a plurality of vehicles according to any preceding claim.

11. A train according to claim 10 characterised in that the train includes at least one of said power vehicles connected in the train at the front and/or the rear thereof and/or at an intermediate position along the length thereof.

12. A method of operating a plurality of vehicles, according to any of claims 1 to 10, characterised by including the steps of driving the individual vehicle or groups of said vehicles to an assembly point, forming the individual vehicle or groups thereof into a train or joining them to a train by use of said coupling means, driving the train from the assembly point to a dispersal point, disconnecting at least some of the coupling means to release at least some of the vehicles from the train and driving those released vehicles individually or in groups away from the dispersal point.

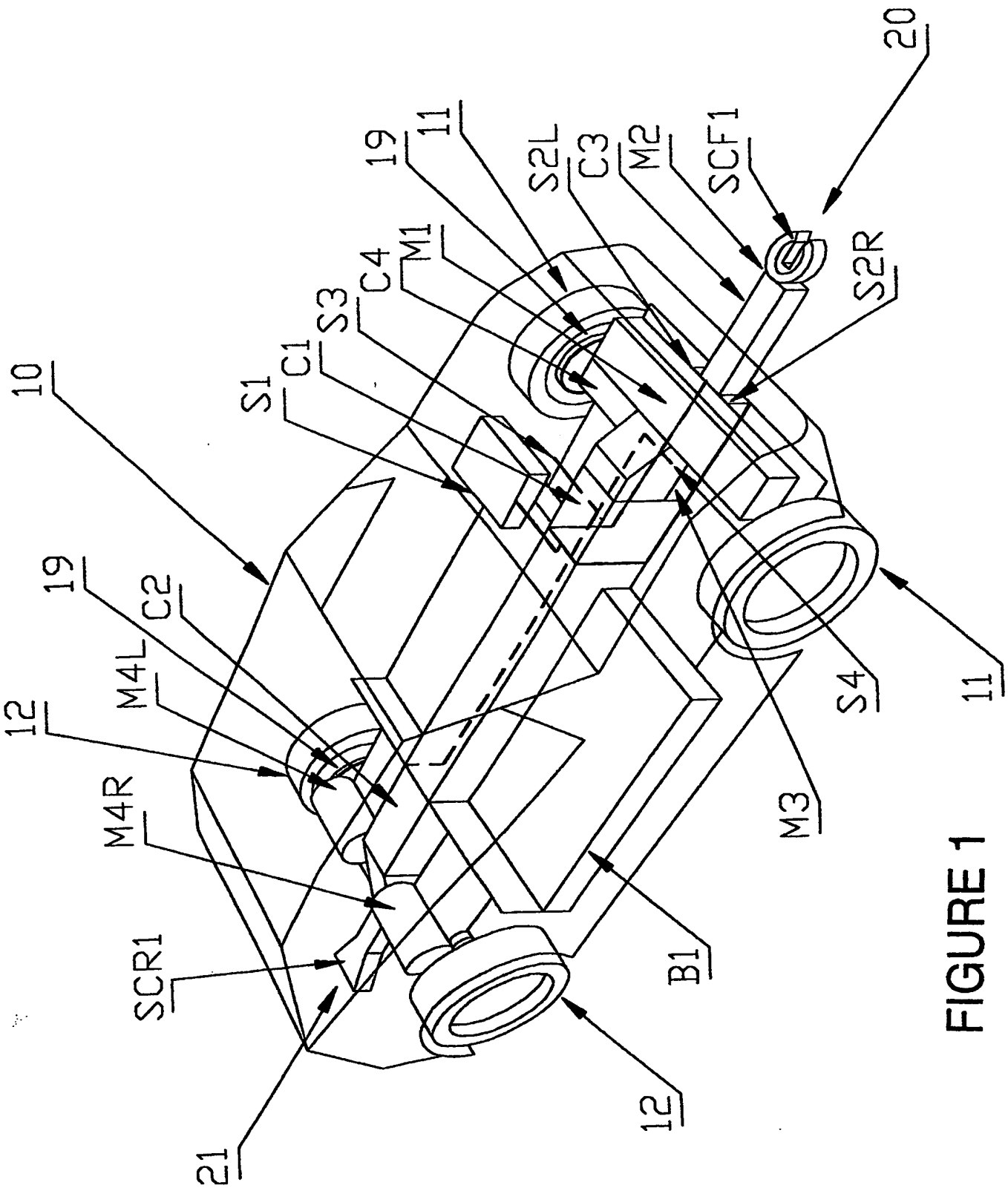

FIGURE 1

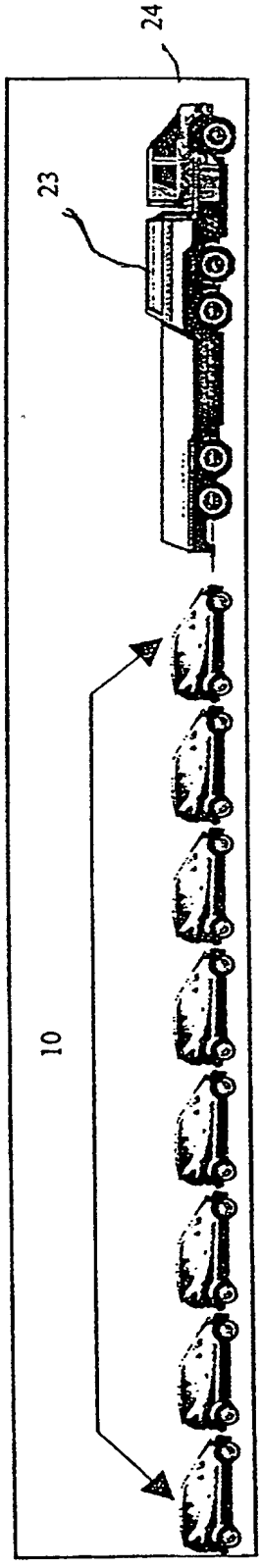

FIGURE 2

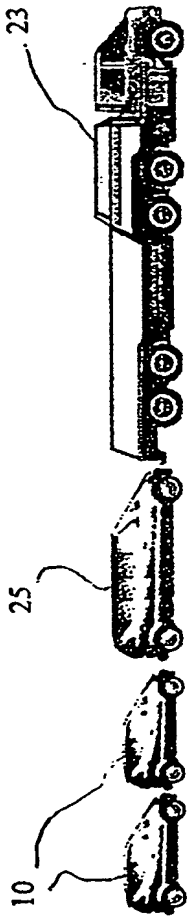

FIGURE 3

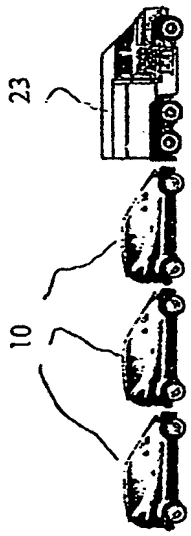

FIGURE 4

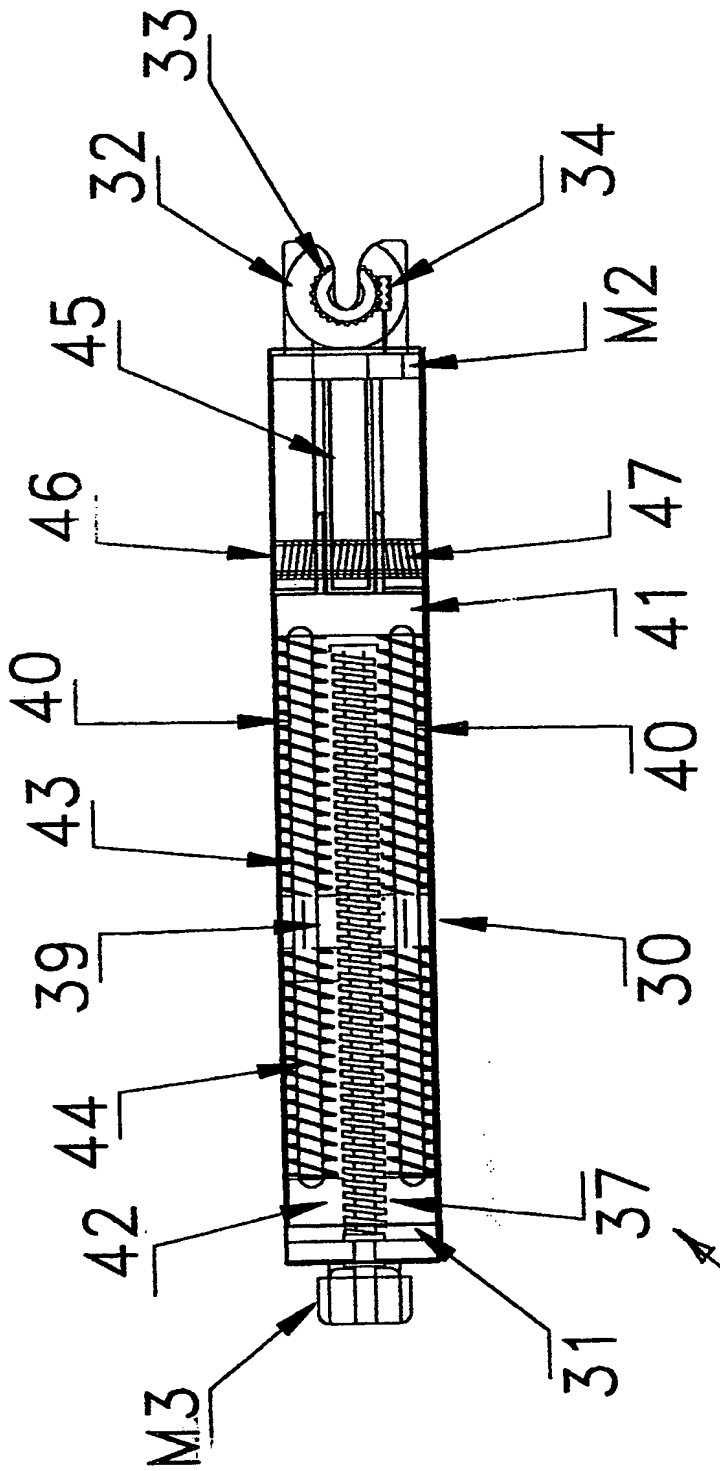

FIGURE 5

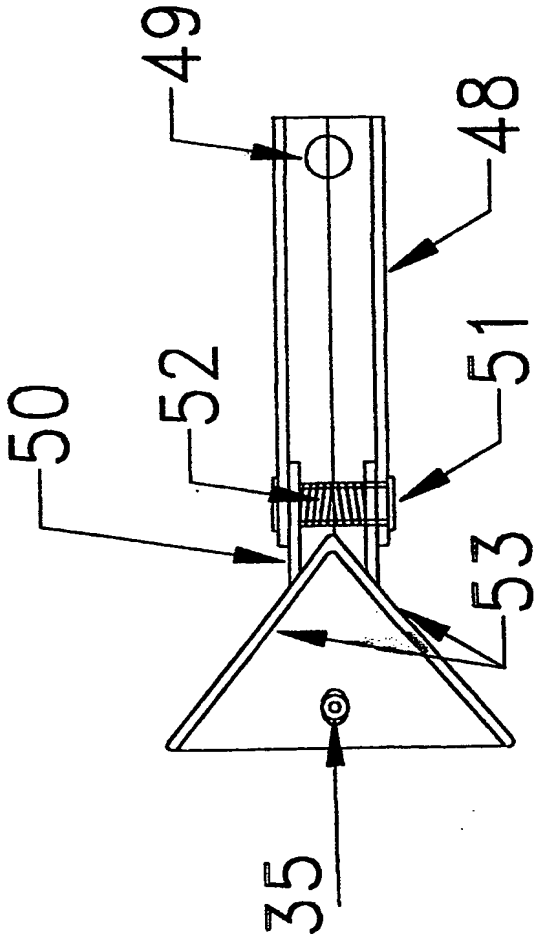

FIGURE 6

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/NZ 98/00030

A. CLASSIFICATION OF SUBJECT MATTER

Int Cl[6]: B62D 53/00, 63/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC: B62D 53/00, 63/02; B61B 3/00, 3/02; B61G 5/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2606354 A1 (GERMANEAU MAGNE) 13 May 1988 Whole document. See in particular page 1, line 30 - page 2, line 11.	1-12
X	US 4794867 A (TITZ) 3 January 1989 Abstract; column 6 line 33 - column 7, line 11; column 7, lines 24-32	1-12
A	DE 4343084 A1 (LENZ) 22 June 1995	

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3 July 1998	- 8 JUL 1998
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200 WODEN ACT 2606 AUSTRALIA Facsimile No.: (02) 6285 3929	Authorized officer S.J. DESCHANEL Telephone No.: (02) 6283 2368

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International Application No.
PCT/NZ 98/00030

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
FR	2606354						
US	4794867	BR	8800044	DE	3700464	EP	277305
		JP	63173706				
DE	4343084						

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